NOx Reduction of a 165 MW Wall-fired Boiler Utilizing Air and Fuel Flow Measurement and Control

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Summary

As a result of increasingly stringent emissions limitations being imposed on coal-fired power plants today, electric utilities are faced with having to make major compliance related modifications to their existing power plants. While many utilities have elected to implement expensive post-combustion NOx reduction programs on their largest generating units, in-furnace NO_x reduction offers a less expensive alternative suitable to any size boiler, to reduce NO_x while also improving overall combustion. In-furnace NOx reduction strategies have proven that, when used with other less expensive approaches (overfire air, fuel switching, and/or SNCR), levels less than 0.15 lb/MM Btu can be economically achieved. Furthermore, when implemented in conjunction with an expensive post-combustion SCR program, initial capital requirements and ongoing operating costs can be cut to save utilities millions of dollars.

For the purpose of developing a system-wide NOx reduction strategy, Santee Cooper, a southeastern U.S. utility, applied pulverized coal flow and individual burner airflow measurement systems to Unit 3 at its Jefferies Station, a 165 MW, 16-burner front wall-fired boiler. The airflow measurement system, in service for many years, applied a well-proven averaging Pitot tube technology to measure individual burner secondary airflow. The coal flow measurement system utilized low energy microwaves to accurately measure coal density and coal velocity in individual coal pipes. The combination of these two systems provided the accurate measurements necessary for controlled manipulation of individual burner stoichiometries, giving the plant the ability to improve burner combustion, yielding a reduction in NO_x levels of 18.7%. While many NOx reduction strategies result in increasing the plant's LOI, during this NOx reduction program, LOI was simultaneously reduced by almost 1%. Optimized burner combustion also resulted in a leveling of the excess O_2 profile, which will enable the plant to pursue further reductions in excess air as well as staged combustion, thus allowing for further NOx reductions in the future.

How this program produced a significant NOx reduction will be presented in detail in this paper. This program will allow for future system-wide planning with regard to possible SCR implementation. In addition, this program will be expanded in April 2002 to incorporate the use of variable orifices in the coal lines to balance coal pipes. By making coal pipe balance the main goal (not burner staging and NOx reduction), significant LOI reductions are expected.